52D CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { EX. DOC. No. 133.

ASSOCIATE PROFESSOR OF MATHEMATICS, UNITED STATES MILITARY ACADEMY.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

An extract from the proceedings of the academic board, United States Military Academy, concerning the appointment of an associate professor of mathematics at that institution.

DECEMBER 17, 1892.—Referred to the Committee on Military Affairs and ordered to be printed.

WAR DEPARTMENT,
Washington, December 15, 1892.

SIR: I have the honor to transmit herewith an extract from the proceedings of the academic board, United States Military Academy, dated November 25, 1892, showing action on the resolution of Prof. Edgar W. Bass, concerning the appointment of an associate professor of mathematics at that institution, the paper of Prof. Bass on the subject being inclosed.

In submitting this extract, the Major-General Commanding the Army states that the department of mathematics is much the most important at the Military Academy, as well as the most extensive, since an adequate knowledge of mathematics is the foundation for all the subsequent scientific studies of the cadets, and adds that the professor of mathematics manifestly needs the assistance which he suggests, and the mode of obtaining that through a permanent associate professor is probably the best one practicable.

To accomplish the needs of the Military Academy in this respect, the Department incloses the draft of an act providing for an associate professor of mathematics, with the recommendation that it receive the favorable consideration of Congress.

Very respectfully,

S. B. ELKINS,
Secretary of War.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

[Extract from the proceedings of the academic board.]

UNITED STATES MILITARY ACADEMY,
West Point, N. Y., November 25, 1892.

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The report of the committee appointed at the last meeting, on Prof. Bass's resolution concerning an associate professor of mathematics, was then read and discussed.

The report is as follows:

UNITED STATES MILITARY ACADEMY,
West Point, N. Y., November 22, 1892.

SIR: The committee, to which the paper of the professor of mathematics was referred, has the honor to report that it has given the paper careful consideration; and it recommends that the following resolution be adopted by the board:

Resolved, That after a careful consideration of the communication submitted by the professor of mathematics to the academic board at its session of November 17, 1892, concerning the necessities of improved instruction in mathematics at the United States Military Academy, the academic board, for the reasons stated therein, respectfully recommends to the honorable Secretary of War the introduction of a bill in Congress substantially as follows:

That there shall be appointed at the Military Academy, in addition to the professors authorized by the existing laws, an associate professor of mathematics, who shall receive the pay and allowances of captain mounted, and when his service as associate professor of mathematics at the Academy exceeds ten years, he shall receive the pay and allowances of major; and hereafter there shall be allowed and paid to the said associate professor of mathematics 10 per centum of his current yearly pay for each and every term of five years' service in the Army and at the Academy: *Provided,* That such addition shall in no case exceed 40 per centum of said yearly pay; and said associate professor of mathematics is hereby placed upon the same footing as regards restrictions upon pay and retirement from active service as officers of the Army.

The committee further respectfully recommends that the suggestions relating to certain modifications in the methods of instruction proposed by the professor of mathematics in the communication referred to be deferred until they are finally decided upon by the professor of mathematics and specifically presented for the consideration and action of the academic board.

Very respectfully, your obedient servant,

P. S. MICHIE,
Professor of Philosophy, Chairman of Committee.

The SECRETARY OF THE ACADEMIC BOARD.

It was then moved that the report of the committee be adopted. Carried.

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A true extract from the records:

JOHN M. WILSON,
Colonel of Engineers,
Superintendent, President Academic Board.

J. M. CARSON, Jr.,
First Lieut., Fifth Cavalry,
Adjutant, Secretary Academic Board.

AN ACT to provide an associate professor of mathematics for the Military Academy.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress asembled, That the President is hereby authorized, by and with the advice and consent of the Senate, to appoint at and for the United States Military Academy, in addition to the professors now authorized, an associate professor of mathematics, who shall receive the pay and allowances of captains mounted, and when his service as such associate professor exceeds ten years the pay and allowances of major; and he shall be further paid an increase of pay for each five years' service at the same rate as that allowed to the said professors, as provided in section 1336, Revised Statutes.

WEST POINT, N. Y., *November 17, 1892.*

SIR: I have the honor to respecfully submit the following statements for the consideration of the Academic Board:

Previous to 1884 the recitations and examinations in mathematics were almost entirely oral. Demonstrations predominated largely over applications. Believing that both were essential, I introduced more examples and exercises into the course with improved results.

About the same time I became convinced that oral examinations alone, in which each student had as a rule a single subject, were very unsatisfactory. The Academic Board received insufficient data from the examination, and the student regarded it largely as a matter of luck. Furthermore, there was no record of the examination work for after consideration in cases where questions as to facts and fairness subsequently arose.

The present method of requiring, in all cases of doubtful proficiency after an oral examination, a written one embracing subjects and applications throughout the course was then adopted, obviating to a great extent the defects of the former method.

Written examinations, however, soon developed the fact that the method of exclusive oral recitations was faulty. Written recitations were then introduced, especially during reviews, so that the necessary instruction upon advance should not be interrupted. The result has been extremely satisfactory, and I believe that the present system of combining written recitations and examinations with the oral compares favorably with that employed in any other similar institution. I am convinced that the successful students acquire a better understanding of the principles than formerly, and the percentage of failures has of late years diminished.

Table showing percentages of failures during the last five years.

Year.	Number admitted.	Number of failures in mathematics during the entire course.	Percentage of failures.
1886	128	54	42
1887	127	45	35
1888	101	24	24
1889	96	32	33
1890	81	15	19

Classes fluctuate from year to year, and some students resign from each to avoid failure, but the above table indicates improved results during the past five years.

Several eminent mathematicians have recently visited the academy, and without exception they have approved of the new methods of instruction. Written papers from different parts of a class were inspected by Prof. Simon Newcomb, of the Johns Hopkins University. He expressed his surprise at the clearness and accuracy with which even the lower men expressed their knowledge, and requested a description of the methods of instruction employed.

The improvements attained have, however, greatly increased the labor in the department. I may safely state that the work of the instructors outside of the section room is now double what it was previous to 1884. The preparation of each set of exercises for written recitations requires time. They should be selected to instruct as well as to test. They must be weighted for marking, all possible answers being well considered beforehand. As I have no clerk they must, as a rule, be hektographed by myself or the assistant professor. The correction of the papers is exceedingly laborious. For examination papers the labor is very much greater. At present I have, including the examinations in arithemetic, at least seven sets of papers to prepare, and several hundred to go over and report upon each year. My assistants aid me materially in correcting papers, but I am forced to acknowledge that the new methods have overwhelmed me with detailed work. I have, therefore, been unable to make proper progress in the revision and preparation of text-books. I have devoted my spare time to the writing of a much-needed new calculus. The analytic geometry is exceedingly poor and should be rewritten. The descriptive geometry does not contain a sufficient number of applications, and these are now drawn and hektographed in the department. The algebra is far behind date, and is necessarily supplemented by much instruction.

I have only praise to accord to my assistants, many of whom, after the necessary experience, make excellent instructors. Teaching is not, however, their profession, and one or two of the four years' detail passes before they acquire the experience

necessary to accomplish the best results. Even then the instruction of their own section is all that can reasonably be expected of them. As a rule, I have no one with me who is familliar with my duties or the methods of the department as a whole. A temporary absence or sickness on my part would soon interfere with the system. My absence may become necessary at any time, and I have a strong desire to visit other institutions, particularly the Naval Academy.

My summer leaves afford me no such opportunities, as all academies and colleges are then closed. In my opinion, a department should be organized so that it will go on smoothly during a temporary absence of its head, and I also believe that many advantages result by relieving the head from a mass of detail and supervising work. The members of the Board are aware of the numerous questions concerning the academy and its curriculum which continually arise, and of the numerous reports which frequently require a review and careful investigation of the entire academic course with all of its intricate details.

I have endeavored to sustain the high standard established by my distinguished predecessor, Prof. A. E. Church, and to introduce such improvements as time and experience naturally suggest. For the future, I have several important plans and propositions to submit. In the first place, I believe that for a four years' course too much time is devoted to the study of pure mathematics. The course for the lower sections has not been increased during the last fourteen years, and is considered the minimum necessary for the proper study of philosophy, engineering, ordnance and gunnery, and drawing. The greater portion of the first two years is now employed in the study of mathematics. In order to diminish the time required daily for lessons in mathematics I purpose recommending that the present method of going three times over such subjects as trigonometry and integral calculus, which consist mainly of formulas, be reduced to two, that is, an advance and one review only. The daily lessons could thus be shortened, and ample time secured for such applications as would instruct the student in the use of formulas not important for training the mind, and which, as a rule, are soon forgotten.

I recommend that the instruction in surveying be made almost entirely practical. The principles employed are those of geometry and trigonometry. The data should be taken by the pupil in the field and plotted by him. The latter requires drawing instruments and facilities only to be found in the department of drawing, and the best methods of delineation are more readily and thoroughly taught in that department.

I would, therefore, go once over some good treatise, as Johnson's or Gillespie's, using it more as a book of reference than a text-book. Afterwards I would turn the subject over to the department of drawing for the practical work. With no mathematical lesson to study, two or three hours in the morning could be devoted to field work, and the data could be plotted in the drawing academy in the afternoon. The instructors of the class in mathematics would, of course, be available for the field work. The graduate would thus obtain a better knowledge of surveying instruments and methods, and the student would have to devote less time daily to the study of the subject.

With the increased facilities which the new academic building will afford for lectures and explanations to large portions of a class together, I hope to be able to give more students the benefit of my knowledge and experience upon the more important points, especially during the advance. These changes, with a little knowledge of algebra at admission to the academy, which I a convinced must soon be required, would enable me to shorten the lessons throughout the two years, thus affording more time daily for other purposes.

I also intend to recommend three or perhaps four examinations per year in mathematics. The periods between examinations at present are too long. The student is required to carry too much by memory. An examination should be thorough or it is of little value. It is only a question of time when formulas not frequently used, will fade from the memory of the ordinary student, and oftentimes from that of the best mathematician. It is sufficient, in general, that a student understands and knows a subject well as he passes over it, and examinations in mathematics should come while the subject is fresh.

The proposed introduction of more lectures and explanations by the professor or other experienced teacher, will without doubt be of material advantage both to the students and new instructors. It should not be understood, however, that the great advantages of the oral recitations are to be sacrificed by the introduction of the written and lecture methods. The latter are merely to supplement the oral which, as in the past, will be the principal feature of the system. A judicious combination of the three methods will, I believe, produce the best attainable results.

The changes proposed will, however, require additional labor from me. I am already overburdened with work, and it is for assistance to carry out the proposed improvements that I now appeal to the academic board. I can not see my way to advance without the continuous assistance of more experienced instructors. I have

referred to the fact that one and two years are necessary for the best section-room instruction alone.

A comprehensive knowledge of the working of the department as a whole and the knowledge necessary to help me in my duties requires several years' experience. Under the present rules I can not always select my first assistant.

The senior in the department is necessarily the first assistant, and it frequently happens that an officer of a later detail has more rank than some who have taught for two or three years. It is not possible to avoid such details, for bright officers are wanted in many places, and the Academy unfortunately has not the first choice. Promising teachers must be taken when available without regard to relative rank. Formerly engineer and ordnance officers could be obtained. When I was appointed professor four were on duty in the department of mathematics. I have been unable to get them for several years. In other words, the highest graduates in mathematics are not, as a rule, available as teachers.

In so many respects have the conditions of the past changed that I feel justified in asking for a corresponding change in the organization of the department. I fully comprehend the advantages of keeping the Army and Academy in close contact by the present system of detailing army officers as instructors, and desire no radical change, but I am forced by the best interests of my department to request the recommendation of the academic board to the honorable Secretary of War for the creation and appointment of one other permanent teacher in the department of mathematics, to be designated "associate professor of mathematics at the United States Military Academy."

I have felt the necessity of this permanent assistance for many years, but have hesitated to request it. I now find that I can not, without such an associate, advance the system of instruction in a manner which I am convinced beyond doubt is best for the department and Academy. In fact, alone I can not properly carry on the present system.

The peculiarities of the labor in the department of mathematics are well understood by the members of the board. It is the basis of the entire scientific course. From 150 to 200 pupils recite daily on a course extending over two years. One class is new to the Academy and its methods, and is composed of much material which is exceedingly poor. Two or three instructors are, as a rule, new each year. Many of the entering class have no conception of the proper methods of study. Much time is spent in showing them how to study, and the first term is employed in developing capabilities for the future rather than in the actual acquisition of knowledge. In the advanced class the higher sections require for the calculus and least squares a bright teacher of several years' experience.

The object of my request is to obtain the best possible results by employing all known methods of instruction to advantage. I believe that I am the only professor of mathematics in an institution comparable with this Academy who has no permanent associate. I ask for one, not for myself except so far as my interests are those of the department and Academy.

Very respectfully, your obedient servant,

EDGAR W. BASS,
Professor of Mathematics, United States Military Academy.

The SECRETARY OF THE ACADEMIC BOARD,
United States Military Academy.